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Koivisto, J.-M.

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Possible Benefits of Gamification for Improving Surgical Patients' Quality of Care

Jaana-Maija Koivisto
University of Helsinki
Finland
jaana-maija.koivisto@helsinki.fi

Jari Multisilta
Tampere University of Technology
Finland
jari.multisilta@tut.fi

Elina Haavisto
University of Turku
Finland
elina.haavisto@utu.fi

Abstract: This paper considers the potential benefits of gamification from the perspective of surgical patients' quality of care. There is little published data on gamifying the work of healthcare professionals even though the use of serious games in healthcare has been growing. Literature on the quality of care shows that patients are often satisfied with the care they have received. However, research indicates that deficiencies exist in patient education, in patients' opportunities to participate in and have impact on decision making regarding their care, and in prevention and management of complications. Workplace culture is significantly connected with the incidence of patient complications. Gamification of healthcare workers' daily work routines could have positive effects on nurses' ownership and the meaningfulness of their work, and on the prevention and management of complications, which would in turn improve the quality of care for surgical patients. In this paper, a hypothetical gamification case is presented and directions for future research are discussed.

Keywords: Quality of Care, Gamifying Healthcare, Nurses' Work Processes

1. Introduction

This article discusses the potential benefits of gamification from the perspective of surgical patients' quality of care. This approach was chosen because earlier research has shown that workplace culture is significantly connected with the incidence of patient complications (Hahtela, 2015). Further, evidence has shown that even though patients are satisfied in general with the care that they have received, deficiencies exist in patient education and in patients' opportunities to participate in and have an impact on decision making with regard to their care (Gröndahl & Leino-Kilpi, 2013). Additionally, this paper goes beyond an ongoing research project investigating the quality of care received by surgical patients and looks to the future by considering possibilities to embed gamelike features into the daily work routines of nurses.

Recently, a considerable amount of literature has emerged around the theme of gamification (Hamari et al., 2014) but there is little published data on gamifying the work of healthcare professionals. In the healthcare sector, serious games have been used in professional education (Graafland et al., 2012; Koivisto et al., 2016b) and in patients' health promotion and rehabilitation (e.g. Burke 2009). However, gamification has not been embedded in the daily work routines of healthcare workers even though it might have positive effects on commitment to and ownership of the work, feelings of belonging to a workplace community, and feelings of achievement. In addition to these, gamification might increase intrinsic motivation (see Huotari & Hamari, 2011) to provide high-quality patient care. Furthermore, from the patients' point of view, patient engagement has been insufficiently instilled into nursing practice even though it could improve the quality and safety of healthcare (Steelman, 2014). According to Steelman (2014), patient engagement is not only about individual patients participating in decisions about their care, but also involving them in designing new facilities, remodelling existing facilities, developing new programs, and carrying out quality improvement projects.

In this paper, the challenges for quality of care are discussed. Further, the benefits of gamification for quality of care are considered, and a hypothetical gamification case is presented. Finally, directions for future research are summarised.

2. Challenges for Quality of Care

Previous research has established that poor workplace culture (Hahtela et al., 2015), nurses' decreased commitment to work (Flinkman et al., 2008), poor clinical reasoning skills (Ludikhuize et al., 2012; Soar et al., 2015), deficiencies in patient education, as well as patients' participation in decision making impair the quality of patient care (Gröndahl & Leino-Kilpi, 2013). There is increasing concern that poor opportunities for professional advancement and development, lack of affective professional commitment, low job satisfaction, and higher quantitative work demands may lead to nurses (especially young qualified nurses) leaving nursing to start a new career in some other profession (Flinkman et al., 2008). Another concern especially related to surgical patients is the fact that workplace culture is significantly connected with the incidence of patient complications (Hahtela et al., 2015). Moreover, van Oostveen et al. (2015) found that one of the most important patient-related factors that influence the care intensity of hospitalised surgical patients is the occurrence of complications. Surgical nurses are focused on direct patient care, such as checking patients' vital signs, guiding patients towards self-care, and providing wound care (van Oostveen et al., 2015). These are all factors that relate to preventing and monitoring complications, which in turn relate to nurses' clinical reasoning skills. Workplaces should invest in the creation of a supportive practice environment (Hahtela et al., 2014), where nurses can use their professional competence to provide the best possible patient care. Hahtela et al. (2015) found that a positive workplace culture is one of the key factors in retaining and recruiting nurses. Thus, workplace culture also affects job satisfaction and quality of care.

Poor or insufficient clinical reasoning can have serious consequences. Previous research has established that nursing staff lack knowledge and skills in the ability to detect signs of deterioration in hospitalised patients, and this may lead to severe adverse events (Ludikhuize et al., 2012; Soar et al., 2015). The quality of surgical patients' care can be improved by recognising and managing complications at an early stage (Friese & Aiken, 2008), since signs of deterioration are clear and can be detected 24–48 hours before a life-threatening event (Ludikhuize et al., 2012). Friese and Aiken (2008) argue that post-operative complications, such as gastrointestinal bleeding and respiratory compromise, are easily detectable by nurses, and those clinical conditions can be managed successfully with timely interventions. The implementation of a simple physiological risk-management tool, Modified Early Warning Score (MEWS), for all surgical in-patients enables improvement in the quality and safety provided to surgical ward patients (Gardner-Thorpe et al., 2015). MEWS includes the measurement of vital signs (see Table 1).

Table 1. Modified Early Warning Score (MEWS) (Ludikhuize et al., 2012).

MEWS score	3	2	1	0	1	2	3
Heart rate		<40	40–50	51–100	101–110	111–130	>130
Systolic blood pressure	<70	70–80	81–100	101–200		>200	
Respiratory rate		<9		9–14	15–20	21–30	>30
Temperature		<35.1	35.1–36.5	36.6–37.5	>37.5		
AVPU score				A (Alert)	V (response to Voice)	P (reacting to Pain)	U (Unresponsiveness)
Worried about patient's condition: 1 point							
Urine production below 75 ml during previous 4 hours: 1 point							
Saturation below 90% despite adequate oxygen therapy: 3 points							

The use of MEWS in daily work requires nurses to learn the MEWS parameters, which could be learned, for example, by using simulation games as a part of regular staff education for recognising, monitoring, and managing critically ill patients (Graafland et al., 2012; Koivisto et al., 2016a, 2016b). Such games replicate reality and allow healthcare professionals to practise patient care in an immersive virtual environment without compromising patient safety (e.g. Dev et al., 2011). This increases staff competence in preventing post-operative complications, and thus improves the quality of care for sur-

gical patients. However, learning the MEWS tool in theory does not guarantee that it is applied in practice.

3. Benefits of Gamification for Quality of Care

To improve the quality of care, one possibility could involve the use of gamification to increase nurses' ownership and the meaningfulness of their work. According to Hamari et al. (2014) gamification has three main parts: 1) the implemented motivational affordances, 2) the resulting psychological outcomes, and 3) the further behavioural outcomes. The motivational affordance categories can include points, leader boards, achievements/badges, levels, story/theme, clear goals, feedback, rewards, progress, and/or challenges. Psychological outcomes often relate to motivation, attitude, and enjoyment (Hamari et al., 2014). The motivational affordances could be implemented in healthcare workplace culture, thus increasing nurses' ownership of their own work and job satisfaction. This in turn would have an impact on the quality of patient care.

However, Hamari et al. (2014) highlight that the role of the context being gamified, and the qualities of the users are essential antecedents for engaging gamification. This is especially true in the healthcare sector, where workers deal with serious issues: they are responsible for patients and their well-being. It might be challenging to implement gamification into healthcare workplace culture; already the terms *gamification* and *gamifying* might be understood narrowly as referring to 'having fun at patients' expense' or 'playing with patients' lives'. Maybe, when referring to the gamification of healthcare professionals' work, some other term could be more convenient and suitable. Nevertheless, gamification that includes social aspects could be beneficial for healthcare workplaces since, as Koivisto and Hamari (2014) found, women in particular value the social aspects of gamification (most nurses are women).

A second advantage of gamification with regard to the quality of care relates to the positive effects and benefits, such as engagement and enjoyment (Hamari et al., 2014). Marques et al. (2015) studied the use of gamification to promote nurses' hand hygiene compliance self-awareness and action. They used an automated monitoring system to collect data in real time and provide feedback information to nurses working in an intensive care unit. They found that nurses liked the concept of leader boards but showed little interest in components such as badges, virtual goods, and content unlocking. The opportunity to obtain feedback and improve performance was rated positively. Similarly, the importance of feedback for improving performance has been found to be important in nursing educational games (Koivisto et al., 2016b). Gamification has a positive influence on learning outcomes, for example, increased motivation, engagement, and enjoyment in the learning tasks (Hamari et al., 2014).

Huotari's and Hamari's (2011) definition of gamification can be applied to improving patients' quality of care. They define gamification as 'a form of service packaging where a core service is enhanced by a rules-based service system that provides feedback and interaction mechanisms to the user with an aim to facilitate and support the users' overall value creation'. When applying gamification to improve patients' quality of care, the core service in a nursing context could be nursing tasks related to high-quality care, for example, preventing and managing complications (see Figure 1 and the hypothetical case). The service could be enhanced by augmenting the prevention and management of complications through the implementation of gamelike features that appeal to nurses' intrinsic motivations. The nurses' intrinsic motivation could be engaged by using motivational affordances, such as clear goals, feedback, rewards, progress, and competition (see Hamari et al. 2014). However, it would be important to investigate what appeals to nurses' or patients' intrinsic motivation, what are the motivational affordances that influence nurses' or patients' intrinsic motivation, and what would be the best reward regarding patient care. After that, the nurses' work could be gamified by using motivational affordances that generate intrinsic motivation (psychological outcome) for implementing high-quality care (behavioural outcome) (see Hamari et al., 2014). Furthermore, changing the behaviour of professionals (an undesired behaviour is abandoned in favour of a new one) requires that a person performs a target behaviour, and to do so, three factors need to be present at the same time: sufficient motivation, sufficient ability, and an effective trigger (AlMarshedi et al., 2017; Fogg, 2009).

3.1 Hypothetical Case

In this hypothetical case, gamification is used to improve the identification of patients at risk for cardiac arrest, which is a common complication for surgical patients. Hamari et al.'s (2014) definition of gamification is applied (see Figure 1). Signs of deterioration are clear and can be detected 24–48 hours

before a life-threatening event (Ludikhuizen et al., 2012). Due to this, it is important to regularly observe critically ill patients and document vital signs in real time in order to prevent cardiac arrests (Resuscitation: Current Care Guidelines Abstract, 2016; Soar et al., 2015). In this case, the use of a mobile documentation device (mobile phone) is thought to promote identification of patients at risk for cardiac arrest. Identification is one of the most important factors in preventing and managing complications. Mobile documentation allows nurses to document information near the patient. With mobile documentation, nurses have up-to-date information about a patient's clinical condition, since it enables nurses to manage measurements and statistics in real time. In addition, the data can be transferred directly to the patient information system. The core work process in this case could be the identification of patients at risk for cardiac arrest. The implemented motivational affordances include the use of gamelike features to engage intrinsic motivation to change behaviour related to the identification of patients at risk for cardiac arrest.

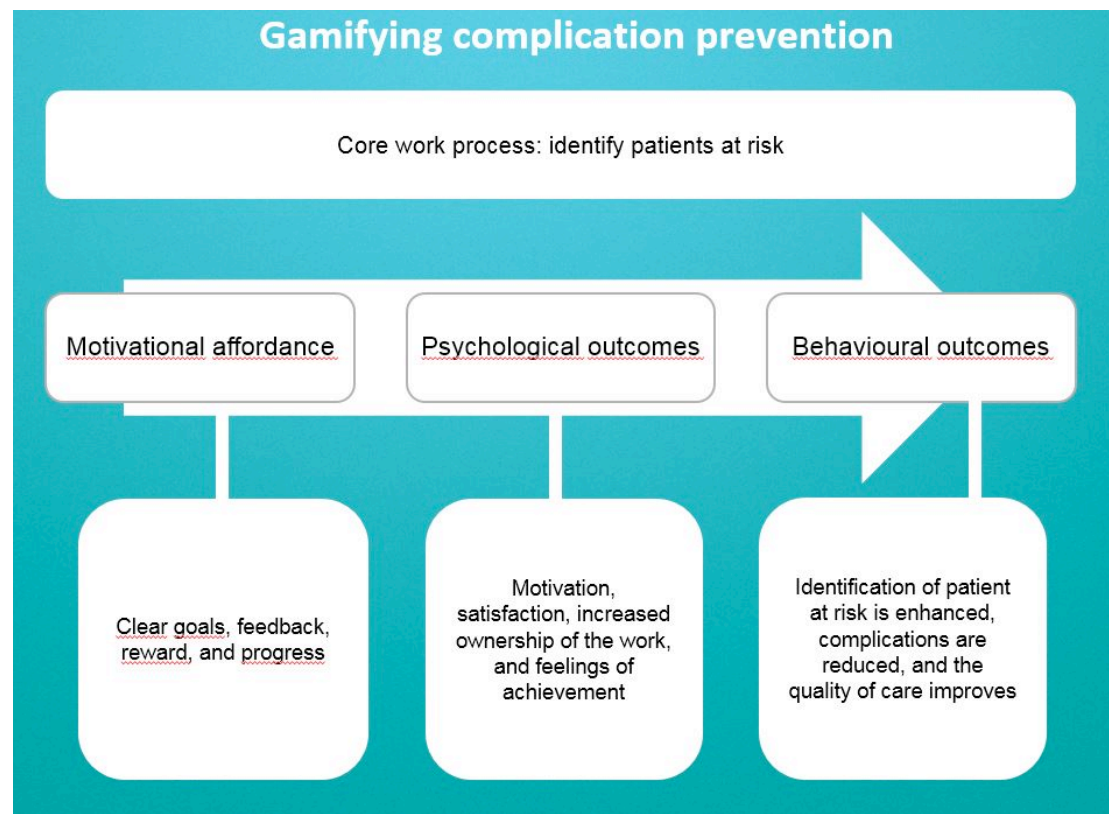


Figure 1. Gamifying complication prevention and management in surgical wards (adopted from Hamari et al., 2014).

The gamelike features could be:

- Goal: identification of patients at risk by monitoring vital signs in real time by using mobile documentation with a mobile phone.
- Feedback: feedback regarding patient's MEWS is provided by using colour effects as triggers to identify patients at risk.
- Reward: patients at risk are identified and cardiac arrests are prevented; satisfaction with own work is increased by being able to prevent complications.
- Progress: data from patient's MEWS is collected and analysed every hour, which makes nurse's documentation visible.

Suppose all nurses have mobile devices and they are instructed to document a patient's vital signs by using mobile documentation every hour. The Fogg Behavior Model (FBM) is applied (Fogg, 2009) to understand the behaviour change related to performing new a task. The expected behaviour change is using a mobile device for documenting vital signs in real time. In this hypothetical case, this task is

new for nurses. The target behaviour is to use mobile documentation to monitor vital signs at regular intervals (i.e. every hour) to identify patients at risk for cardiac arrest. In the mobile documentation, the MEWS is applied to identify deteriorating patients (see Table 1) (Ludikhuize et al., 2012). Using the device means that a nurse documents a patient's vital signs once in every hour by using the mobile device. The device analyses the data by using MEWS as a framework. Motivation to perform the target behaviour refers here to the nurse's motivation to use mobile documentation to monitor vital signs at regular intervals. Low motivation means that the nurse does not use the mobile documentation device to document vital signs because, for example, he or she might think that it is one more new task in a busy work shift. High motivation means that the nurse documents the vitals sign at regular intervals by using the device. Ability to perform a target behaviour refers here to the ability to use the mobile documentation device to monitor vital signs at regular intervals. The nurse might have a low ability to use the mobile documentation device because, for example, of a non-intuitive user interface, lack of mobile devices, or lack of time. The trigger in this case is the visual representation of MEWS in the mobile phone display: Colour effects demonstrate the points in the MEWS to help the nurses notice changes in a patient's vital signs and to identify patients at risk for cardiac arrest (see Table 2). Green refers to zero (0) points, yellow refers to one (1) point, and red refers to two and three (2–3) points in MEWS (see Tables 1 and 2). In this way, the trigger is associated with the behaviour: the nurse uses the mobile documentation device at regular intervals (is motivated and has the ability) and is able to see the changes in patient's clinical condition in real time. This in turn supports the behaviour change, which in this hypothetical case is using mobile documentation with a mobile device as part of the nurse's daily routine. This enables the management of complications and further improves the quality of patient care.

Table 2. Patient's MEWS at 1:00, 2:00 and 3:00 p.m. in the mobile device display.
This table is a hypothetical example (i.e. not real patient data).

MEWS 1:00 p.m.	MEWS 2:00 p.m.	MEWS 3:00 p.m.
Heart rate	Heart rate	Heart rate
Systolic blood pressure	Systolic blood pressure	Systolic blood pressure
Respiratory rate	Respiratory rate	Respiratory rate
Temperature	Temperature	Temperature
AVPU score	AVPU score	AVPU score
Worried about patient's condition: 1	Worried about patient's condition	Worried about patient's condition
Urine production below 75 ml during previous 4 hours	Urine production below 75 ml during previous 4 hours	Urine production below 75 ml during previous 4 hours
Saturation below 90% despite adequate oxygen therapy	Saturation below 90% despite adequate oxygen therapy	Saturation below 90% despite adequate oxygen therapy

4. Directions for Future Research

This paper has considered the potential benefits of gamification to improve the quality of care of surgical patients. Further research should be undertaken to establish whether quality of care can be improved by gamifying, for example, prevention, recognition, and management of post-operative complications. New knowledge on motivational affordances that produce psychological outcomes and further behavioural outcomes (see Hamari et al., 2014) in surgical patients' care is needed from nurses' and patients' points of view.

What is now needed is a study involving researchers, practising nurses, and doctors in collaboration to explore how gamification could be implemented in patient care. By involving nurses and doctors in the process, their ownership regarding the new approaches can be strengthened, which increases the likelihood of promoting the intended outcomes (Marques et al., 2015; de Vito Dabbs et al., 2009). One possible methodological approach could be design-based research, which leads to the development of knowledge that advances pragmatic and theoretical aims (Design-Based Research Collective, 2003; Wang & Hannafin, 2005). Design-based research is well suited to gamifying work processes since it is conducted over a long period within a single real-life setting, which increases the likelihood that gamification can be embedded in the daily routines of nurses' work and patient care. Another possible research design could be a randomised controlled trial that investigates the effectiveness of a gamified

intervention to prevent surgical patients' cardiac arrests by using an intervention group and a control group. Nevertheless, in order to implement gamification in the healthcare sector on a larger scale, more research is needed to better understand the benefits of gamification for the ownership and the meaningfulness of nurses' work.

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